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try is more densely settled than it was one or two decades ago, and many local storms would now be observed where they could not have been seen and reported some years ago. Thus, the average number of tornadoes reported annually for the last ten years is 159, while for the previous ten years it was only 45. For this reason, it would not be safe to compare the spots with any former cycle. In order to make the figures for 1878-89 fairly comparable, those for the first three or four years may be raised slightly, perhaps; and those for the last two may be increased 2 or 3 per cent by belated returns. The annual average, then, would be more than 160 (say 170), with minima at the ends of the series, and a maximum near the centre:—

Year.	Spots.	Tornadoes.	Year.	Spots.	Tornadoes.
1878	3.4	77	1884	63.3	216
1879	6.0	88	1885	50.3	139
1880	31.6	141	1886	25.7	290
1881	54.1	113	1887	13.1	173
1882	59.3	90	1888	6.7	122
1883	62.8	167	1889	6.1	129

Another curious fact is that the greatest number of tornadoes reported upon one day, according to Finley, was 60, on Feb. 19, 1884. Wolf's relative number for January, 1884 (92.1), is the largest for any month during this whole cycle, except April, 1882 (97.0); but the average for the six or seven months beginning with October, 1883, is much greater than for any similar period in 1882. Tacchini (says *Nature*, July 1, 1886, p. 194) fixes the height of solar excitement in February, 1884; but Professor P. M. Garibaldi of Genoa quotes Tacchini as placing the maximum in May, 1884. The maximum of protuberances found by Tacchini (*Nature*) was in March, 1884, though Garibaldi says June–August, 1884. At the Royal Observatory, Greenwich, the rotation-period (27 days) containing the largest daily average spottedness in twelve years, began July 4, 1883, when it was 2,037 millionths of the sun's visible hemisphere; but the best two-period exhibit was from Dec. 14, 1883, to Feb. 7, 1884, when the daily mean was 1,817 millionths. The greatest facular displays recorded in the Greenwich "Results" were in the rotation-periods beginning Dec. 14, 1883 (3,151 millionths) and Feb. 7, 1884 (3,467 millionths). Garibaldi, at the Royal University, Genoa, recorded the greatest magnetic variation (in the needle's daily swing) in April–July, 1884, and from August, 1885, to April, 1886. At Toronto, the biggest magnetic storms of the maximum stage of this last sunspot cycle occurred in November, 1882, September, October, November, 1884, and March, 1886. During the first seven months of 1884, at Toronto, the magnetic perturbations were few and slight.

The general yearly parallel between spots and tornadoes is far from proving any relation between the phenomena; and the correspondence between the maxima of spots, protuberances, magnetic variations, magnetic storms, and tornadoes is not very close. Yet the comparison here made is not without interest.

JAMES P. HALL.

Brooklyn, N. Y., May 1.

#### BOOK-REVIEWS.

*Graphics, or the Art of Calculation by Drawing Lines.* By ROBERT H. SMITH. Part I. London and New York, Longmans, Greene, & Co. 8°.

THIS work treats of graphics as applied especially to mechanical engineering. The volume before us is but the first part of the complete treatise, and deals mainly with the analysis of stresses in engineering structures. It is accompanied by an atlas containing twenty-nine plates and ninety-five diagrams, the text and the diagrams being each essential to the better interpretation and ready comprehension of the other. The second part of the work, which it is hoped will soon be published, will deal mainly with synthetic problems, aiming more at the design than the analysis of structures and machines.

The department or branch of descriptive geometry dealt with in this work, the "art of calculation by drawing lines," has assumed considerable importance, so that Professor Smith's scientific treatise on the subject is as timely as it is practical and comprehensive. The graphic method of computation, of course, has limitations in many directions, being less useful in simple cases than arithmetical and algebraic methods; but the method once thoroughly mastered, and its scope and limitations clearly understood, it will enable those who have a knowledge of elementary mechanics to utilize that knowledge to better advantage and with a greater degree of thoroughness, and to apply it to many of the every-day problems of engineering science without the aid of the more complicated portions of algebraic and trigonometrical mathematics or of the differential and integral calculus. Wherever the method is applicable, its use will result in a saving of mental fatigue, as it possesses great simplicity in many of its applications, leaves but little opportunity for the accumulation of gross errors, and is in itself a test of its own accuracy.

The work opens with a glossary of special terms and symbols, some of which are new and possessed of advantages in the matter of conciseness and precision. The introductory chapter presents clearly and with evident impartiality the advantages as well as the disadvantages of the method, and gives a brief sketch of the theoretical development of the subject. This is followed by a chapter on the instruments needed in the accurate working-out of the method; after which follow in order chapters on graph-arithmetic, graph-algebra, graph-trigonometry and mensuration, combined multiplication and summation, moments of parallel vectors, vector and rotor addition, locor addition and moments of locors and of rotors, the kinematics of mechanisms, flat static structures without beam links, flat static structures containing beam links, and solid static structures. The diagrams in the accompanying atlas are neatly engraved, and clearly printed on heavy plate paper.

#### AMONG THE PUBLISHERS.

THE issue of *Harper's Weekly* for April 26 devotes considerable space to the Stanley-Emin relief expedition. The article, which is copiously illustrated, gives the whole history of the expedition.

—A cheap edition, limited to a hundred thousand copies, of "Tom Brown's School-Days," is announced by Macmillan & Co., uniform in style with their paper-covered editions of Charles Kingsley's novels, of which something over a million copies have been sold in the past six months.

—One of the literary sensations of the winter in Paris was Camille Flammarion's astronomical romance, "Uranie," of which the Cassell Publishing Company are the American publishers. Up to the present time, M. Flammarion has been known as an astronomer, but now he has become a popular romancer. Mrs. Mary J. Serrano, translator of "Marie Bashkirtseff: The Journal of a Young Artist," has put M. Flammarion's French into English.

—In *Garden and Forest* for last week, Mr. H. H. Hunnewell, whose gardens at Wellesley, Mass., have been famous for a generation throughout the country, writes of rhododendrons and their culture; Professor Greene continues his notes on the shrubs of California; and the concluding portion of the review of Dr. Mayr's great work on the forests of North America is given. "The Woods in Spring," "Wild Plants under Cultivation," and "Hardy Plants for Cut Flowers," are titles of other articles. A road in Sherwood Forest is the subject of one illustration, and there is also a picture of a giant *Cattleya*.

—Messrs. Ginn & Co. announce as in press "Political Science and Comparative Constitutional Law" (two volumes), by J. W. Burgess, professor of constitutional and international law and history in Columbia College. In these two volumes Professor Burgess sets forth the general principles of modern political science and constitutional law. The State, as sovereign organization of the Nation, is sharply distinguished from the government. Government, to the author, is but one of the means through which the State attains its ends. The other means is liberty. The first volume treats of the Nation and the State as concepts of